

- 1. Project Title** Alternatives to Burning and Their Effects on Insect, Weed, and Disease Pests in Alfalfa Seed Fields
- 2. Submitted to** The Agricultural Burning Practices and Research Task Force
- 3. Funding** \$49,068 is requested to cover research and knowledge dissemination efforts from 11/1/05 through 1/31/07
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Administrator, Northwest Alfalfa Seed Association
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PROPOSAL SUMMARY
Alternatives to Burning and Their Effects on Insect, Weed, and Disease
Pests in Alfalfa Seed Fields

Project Rationale. We propose to evaluate the costs and benefits of burning alfalfa seed fields in Washington State by testing cultural and chemical alternatives to burning for efficacy within an Integrated Pest Management framework. Knowledge gained will permit formulation of a long-term follow-up plan of burning for pest control now required by the state.

Background. Alfalfa seed producers burn fields to decrease insect, weed, and disease pests and to eliminate crop residues. In the Walla Walla Valley, fields are burned in late winter when the alfalfa plants are dormant, targeting insect pests including chalcids, weevils, and *Lygus*. Additionally, prickly lettuce, dog fennel, sow thistle, and other winter annual weeds and diseases including *Sclerotinia* and *Verticillium* can be suppressed by burning. The main alternative to field burning is hay removal or incorporation and increased pesticide use. Pesticides provide obvious economic benefits but overuse can result in negative environmental impacts. And while mechanical alternatives to field burning can leave less residue in the field, they can be costly and disposal of the removed residue is problematic.

Objectives.

1. Evaluate the efficacy of alternatives to field burning on insect, weed, and disease control.
2. Determine the costs and benefits of field burning and alternative practices.
3. Develop a long-term follow-up plan for field burning as directed by state guidelines.
4. Disseminate key results of this research to growers via meetings, publications, and the Internet.

Procedures.

1. Plots will be established in Touchet, Washington during fall 2005.
2. Proposed field treatments will include a non-treated/non-burned control, burning, heat treatment with steam, flash freezing with carbon dioxide, field stubble removal, conventional tillage, and insecticide and herbicide application. Treatments are explained in greater detail within the project narrative following. Each treatment will be replicated 4 times in 1600 ft² plots in a randomized complete block design.
3. Field efficacy will be evaluated for all major pest groups. Insect populations will be monitored following the treatment by sampling weekly through the spring of 2006 with sweepnets, pitfall traps, yellow sticky traps, and Plexiglas[®] flight traps. Weeds will be monitored by monthly visual evaluations and counts by species. Incidence of *Sclerotinia* and *Verticillium* disease will be determined by surveying plots for plants exhibiting indicative symptoms.
4. Direct efficacy of treatment will also be measured. Small wire mesh packets containing prickly lettuce (*Lactuca serriola*) weed seeds, *Lygus* bugs, and disease inoculum will be placed on the soil surface and at depths of 1, 3, and 5 inches below the soil surface before the field treatments are applied. After treatment, these packets will be removed and transported to WSU Prosser. The weed seeds and disease inoculum will be evaluated for germination and sporulation and the insects will be rated for mortality. In fall 2006, seeds will be harvested from each of the plots and evaluated for the presence of *Verticillium* disease.

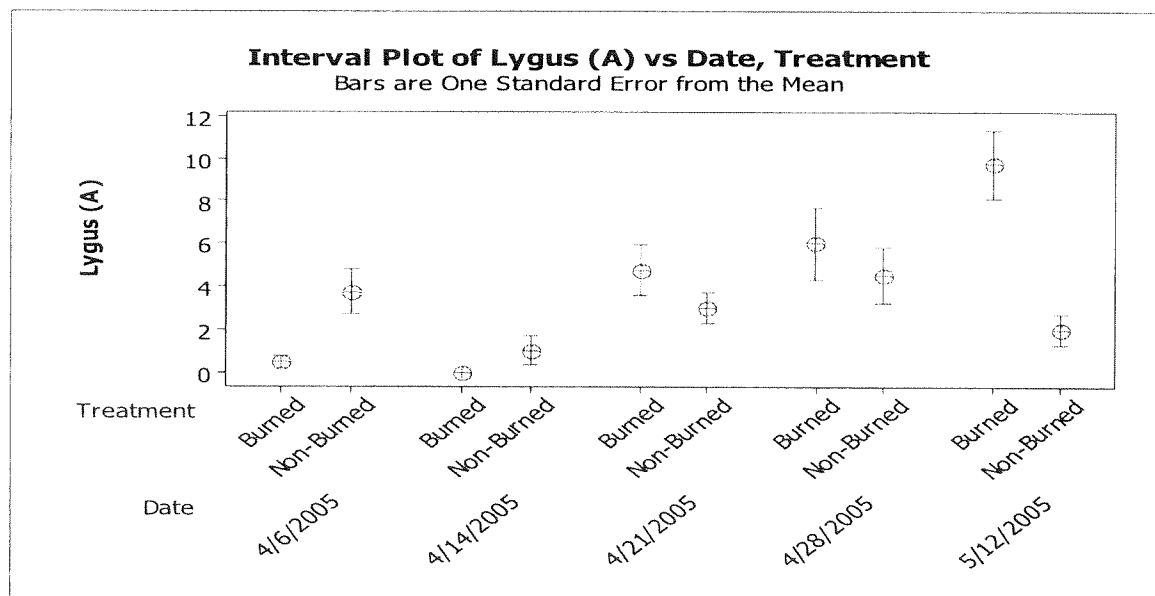
Dissemination. The Washington State Alfalfa Seed Commission is coordinating this project and will take an active role in disseminating results. Walsh is the IPM Coordinator for Washington State University and the Extension Entomologist for alfalfa seed. WSU Extension is represented locally in southcentral Washington by Extension Agent Moberg. Field days will be conducted, presentations will be made at several alfalfa seed conventions, newsletter articles and other publications will be written, and results will be placed on the WSU IPM webpage, <http://ipm.wsu.edu>.

food/non-feed status provides alfalfa seed producers the competitive benefit of being able to use pesticide chemistries that have either been eliminated through regulation on consumed products or to obtain the use of new crop protection chemistries that have not yet been approved for use on food products.

2. Related and Current Work in the Area

Historically, burning has been an important step in farming and grazing operations. Native Americans and early settlers routinely burned Pacific Northwest grasslands in late fall or early spring to promote early vegetative growth. The role of field burning in pest management has been less straightforward. In a 1932 study by Rice results varied, with *Lygus* spp. increasing in some instances and decreasing in others subsequent to burning of vegetation, but the general trend for all insects was that populations decreased 35% with burning. Cancelado and Yonke (1970) found that the burning of litter can decrease grasshopper populations by causing direct mortality to nymphs occurring within the litter. Conversely, Cancelado and Yonke (1970) and Winter (1984) found that increased plant productivity in grasslands likely contributed to increased Hemipteran populations following burning.

Burning of alfalfa seed residue is known to reduce alfalfa seed chalcid populations, and growers believe that *Lygus* and alfalfa weevil are less of a problem following a burn. Preliminary data (see figure below) collected in spring 2005 in Touchet, Washington from adjacent burned and unburned fields showed fewer insects in burned areas during early spring collections. As the spring progressed, that trend shifted, with more *Lygus* being collected in the burned field. The proximity of the fields to one another coupled with the dispersal capability of *Lygus* likely accounted for this trend. A more detailed evaluation of juvenile *Lygus* would likely provide more accurate data.



Flumioxazin, diuron, and ethalfluralin are currently being evaluated for weed control in alfalfa seed production in the Warden, Washington area. Our results in other crops (peppermint and

manifold and grape suckers are controlled. This device could control all insects within the field stubble or at or just below the soil surface. **Treatment 4 (flash freezing)** will be accomplished with the release of liquid carbon dioxide through a siphon tube and sprayed onto the field stubble/soil surface with conventional agricultural spray equipment. **Treatment 5 (field stubble removal)** will be accomplished with a modified Snapper lawn mower. **Treatment 6 (conventional tillage)** will be accomplished with discing, use of a skew treader, use of a drag harrow, or use of a rototiller connected to a small Kubota™ tractor. **Treatment 7 (insecticide and herbicide application)** will consist of incorporating several insecticides including granular chlorpyrifos (Lorsban 15G™ Dow Chemical Co.) into the soil and spraying thiamethoxam (Actara™ Syngenta Chem. Co.) over the soil surface. Herbicide treatments may be split over treatments 2, 5, and 6. Herbicide treatments will include paraquat (Gramoxone) + flumioxazin (Chateau) or paraquat + diuron (Karmex) applied in the fall prior to most winter annual weed emergence and ethalfluralin (Sonalan) and flumioxazin applied in the spring for summer annual weed control. The grower's standard herbicide practice and a non-treated check will be included for comparison.

Monitoring and evaluation will take place in several ways. Insect populations will be monitored following the respective treatments by sampling every week through the spring and summer of 2006 with sweepnets, pitfall traps, yellow sticky traps, and Plexiglas insect flight traps. Insects collected will be transported to the Environmental and Agricultural Entomology Laboratory for identification and quantification. Weed populations will be monitored monthly by visual evaluations and counts by species. In-field incidence of disease will be monitored visually by surveying plots for plants exhibiting indicative symptoms of the target diseases Sclerotinia and Verticillium.

As an additional means of monitoring and measuring direct efficacy, researchers will place small wire mesh packets containing prickly lettuce seeds, Lygus bugs, and disease inoculum on the soil surface and at depths of 1, 3, and 5 inches below the soil surface before the field treatments are applied. After treatment these packets will be removed and transported to WSU Prosser. The weed seeds and disease inoculum will be evaluated for germination and sporulation and the insects will be rated for mortality.

As a final measure of disease control, seeds will be harvested from each of the plots in fall 2006 and evaluated for the presence of Verticillium. As disease-free alfalfa seed is critical to forage alfalfa growers and subsequently livestock producers, this is a critical measure.

Objective 2: Determine the costs and benefits of field burning and alternative practices.

The benefits in terms of pest control efficacy will be examined and evaluated as described under Objective 1. Costs of each treatment alternative will be recorded for economic analysis. We will also measure alfalfa seed yield results from each of the various treatments. By developing a matrix of the treatment efficacies, costs, and yields, we will determine the costs, benefits, and therefore relative utility of the various treatment practices.

Objective 3: Develop a long-term follow-up plan for field burning as directed by state guidelines.

January 2006	Begin field monitoring of insect, weed, and disease population presence and abundance in field plots.
February 2006	Conduct field research and apply the burn, freeze, and steam treatments.
March 2006	Apply the insecticide and spring herbicide treatments
March to October 2006	Evaluate the abundance and diversity of weeds and insects present within the field plots.
April 2006	Evaluate the effect of the field treatments on the seed germination rates of candidate weed species.
June 2006	Conduct a grower field day and discuss the preliminary results derived from the study.
September to December 2006	Formulate recommendations toward development of long-term follow-up plan (as directed by state guidelines) and other written communications.
November 2006 to January 2007	Attend and make presentations at grower and commodity meetings. Write up research results, submit reports, and begin preparing Extension Bulletins and other publications.
January 2007 to June 2007	Publish Extension bulletins and submit manuscripts based on research results. Update and develop recommendations on industry and WSU websites. Complete the long-term follow-up plan for burning required by state mandate for commodities employing agricultural burning.

6. Evaluation

One measure of success of this project will be the publication of a long-term follow-up plan for agricultural burning in Washington State alfalfa seed fields as required by the Washington State Department of Ecology. Another measure will be the existence of one full field season's worth of data comparing field burning to six other methodologies for cost and pest control efficacy. A third measure will be the presence of this data on the Washington State University Integrated Pest Management website at <http://ipm.wsu.edu>. A fourth measure of success will be the number of alfalfa seed growers reached with face-to-face presentations of our findings, beginning in June 2006 and continuing throughout the refinement of the data analysis into the following winter and spring seasons; this will include a high percentage of the state's alfalfa seed growers. Finally, a fifth measure of success will be the number of printed publications explaining the data and making recommendations for integrated pest management practices based on this research. Due to the time constraints of this funding block, this project will not include a survey of grower adoption of recommended practices. Such a survey could not be undertaken with any accuracy until after the period of this particular funding cycle is over, but will likely be a recommendation for future evaluation of the project's efficacy.

Management Specifications

A. Identifying Information

1. Washington State Alfalfa Seed Commission
c/o Mr. Rod Christensen, Administrator
100 N. Fruitland, Suite B
Kennewick, WA 99336
Tel: 509.585.5460, Fax: 509.585.2671
Email: rodca@agmgt.com

2. Principal officers

Washington Alfalfa Seed Commissioners

Dist/Position	Name	Address	E-Mail
1-1	Don Underhill	496 Hwy 17 South Warden, WA 98857	dunderhill@atnet.net
1 2	Roger Hastings	9252 N Dale Rd Moses Lake, WA 98837	n/a
2 3	Zachary Stephenson	320 Stephenson Rd Wapato, WA 98951	n/a
3 4	Kirk Baumann	8417 Frog Hollow Rd Touchet, WA 99360	baumann@wwics.com
3 5	Russell Byerley	1039 Beyerley Rd Touchet, WA 99360	n/a
3 6	Mark Wagoner	371 Bald Rd Touchet, WA 99360	wagoner@pocketinet.com
7	Rick Ames	3630 Rd F N.E. Moses Lake, WA 98837:	rames@atnet.net
8 (WSDA)	Victor Shaul	21 N 1st Ave, Suite 203, Yakima, WA 98902	vshaul@agr.wa.gov

3. Legal status of bidder and year entity was established

The Washington Alfalfa Seed Commission was established as a commodity-based organization in 1955 and is currently organized within the Washington State Department of Agriculture under RCWs 15.6 and 15.6.

4. Federal employer ID number and Washington UBI number

Federal I.D. # 75-3059491, Washington UBI #602 187 946 000

5. Project Manager

Mr. Rod Christensen, President, Ag Management Inc.
Administrator, Washington State Alfalfa Seed Commission
100 N. Fruitland, Suite B
Kennewick, WA 99336
Tel: 509.585.5460, Fax: 509.585.2671
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6. Location of the facility from which the applicant will operate

The project will be managed out of the Ag Management office in Kennewick, WA. The field research will be conducted in Touchet, WA by scientists that reside at the WSU/ USDA Research and Extension Center located in Prosser, WA.

7. Contracts with the State of Washington on the part of the applicant in past 24 months

The relationship between the Washington Alfalfa Seed Commission and the State of Washington is described under item 3, above. Ag Management, Inc. contracts to do consulting work for agricultural associations. Associations for which Rod Christensen serves as Executive Director include Washington Alfalfa Seed Commission, Washington Hay Growers Association, and

References

- Alternatives to Agricultural Burning: Agricultural Practices to Help Reduce or Eliminate the Need to Burn. 2004. State of Washington Department of Ecology Air Quality Program. http://www.ecy.wa.gov/programs/air/aginfo/research_pdf_files/AlternativesAgBurn.pdf web access verified May 23, 2005.
- Cancelado, R., and T.R. Yonke. 1970. Effect of prairie burning on insect populations. *J Kans Entomol Soc* 43:274-281.
- Larsen, R. C., G. J. Vandemark and T. J. Hughes. 2004. Development of a SCAR marker for detection of *Verticillium albo-atrum* in alfalfa cultivars and subsequent quantification of pathogen DNA using real-time PCR. Proceedings of the North American Alfalfa Improvement Conference.
- Leath, K. T. and B. W. Pennypacker. 1990. Verticillium wilt. pp. 39-41. *In* Compendium of Alfalfa Diseases. (2nd Edition). American Phytopathological Society Press, St. Paul, MN.
- Rice, L. 1932. Effect of fire on prairie animal communities. *Ecology* 13:392-401.
- Rhodes, L. H. and R. G. Gilbert. 1990. Sclerotinia crown and stem rot. pp. 26-28. *In* Compendium of Alfalfa Diseases. (2nd Edition). American Phytopathological Society Press, St. Paul, MN.
- Winter, B.M. and L.B. Best. 1985. Effect of prescribed burning on placement of sage sparrow nests. *Condor* 87:294-299.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by CSREES.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first)	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL \$ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTE D	TITLE OF PROJECT
R. Boydston	Active: Washington Mint Commission/MIRC	\$ 24,889	Mar. 05 - Mar. 06	15%	Weed Control Research in Mint
R. Boydston, R. Baker	Mint Industry Research Council	\$11,000	Mar. 05 - Mar. 06	1%	Advanced mint variety testing
R. Boydston, R. Baker	Washington State Commission on Pesticide Resgistration	\$4,000	Mar. 05 - Mar. 06	5%	Mint tolerance to growth regulator herbicides and postemergence broadleaf weed control low rates of sulfentrazone and mesotrione.
R. Boydston	Washington State Commission on Pesticide Resgistration	\$3,000	Mar. 05 - Mar. 06	3%	Volunteer potato control in snap beans.
R. Boydston	Miscellaneous Chemical Companies (Gowen, BASF, FMC, Valent-USA, Syngenta, DuPont)	\$10,000	None	5%	Weed Control in Irrigated Crops
R. Boydston	Pending: Miscellaneous Chemical Companies (Amvac, Bayer, FMC, DuPont)	\$9,000	None	5%	Weed Control in Irrigated Crops

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Form CSREES-2005 (12/2000)

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Environmental Education Specialist • Integrated Pest Management Coordinator
Washington State Liaison Representative to the USDA IR-4 Project
Ex officio Commissioner, Washington State Commission on Pesticide Registration.
Research Director, Environmental and Agricultural Entomology Laboratory

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EDUCATION

Ph. D.	Entomology	University of California, Davis	1998
B. S.	Biology-Plant Sciences	University of California, Santa Cruz	1980

SELECTED PUBLICATIONS

Waters, T.D., H.J. Ferguson, R.P. Wight, and D.B. Walsh. 2004. Chemical Control of McDaniel Mite *Tetranychus mcdanieli* Koch in Timothy Hay. Arthropod Management Tests.

Waters, T.D., H.J. Ferguson, R.P. Wight, and D.B. Walsh. 2004. Insecticide Effects on Pest and Beneficial Arthropods in Alfalfa Seed. Arthropod Management Tests.

Williams, M.M. & D.B. Walsh. 2004 Integrating arthropod herbivory and reduced herbicide use for weed management. Weed Science 52:1018-1025

Walsh, D.B., T. D. Waters, & R.S. Zack. 2004. Plant community effects on arthropod abundance in riparian buffers. Society of Wetland Sciences. Seattle, WA.

Walsh D., M. Bush, T. Waters, H. Ferguson, and R. Wight. 2004. *Lygus hesperus*- studies in Washington State apple orchards. Pacific Branch of the Entomological Society of America. Bozeman, MT.

Walsh, D. 2000. Lygus in Western Landscapes- Lygus in the Pacific Northwest. In. Proceedings, The Lygus Summit. Visalia, CA. pp. 9-11.

Walsh, D., F. Zalom, N. Toscano, & B. Brindley. 1997. *Lygus hesperus* controls on California strawberries. An economic and resistance management analysis. Entomological Society of America. San Jose, CA.

Pickel, C., F. G. Zalom, D. B. Walsh, & N. C. Welch. 1994. Efficacy of vacuum machines for *Lygus hesperus* Knight (Hemiptera: Miridae) control in coastal California strawberries. J.Econ. Entomol.87(6): 1636-1640.

Zalom, F. G., C. Pickel, D. B. Walsh & N. C. Welch. 1993. Sampling for *Lygus hesperus* Knight (Hemiptera: Miridae) in strawberries. J. Econ. Entomol. 86(4): 1191-1195.

Pickel, C., D.B. Walsh, & N.C. Welch. 1990. Using degree-days to time insecticide sprays for *Lygus* control. Santa Cruz County Extension Publication. 6 pp.

GEORGE J. VANDEMARK
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EDUCATION

Ph. D.	Plant Pathology	University of Arizona	June 1991
M. S.	Genetics	Pennsylvania State University	Aug. 1985
B. S.	Biology	Pennsylvania State University	Dec. 1983

PROFESSIONAL EXPERIENCE

Aug. 1998–present, **Research Geneticist**, USDA Agricultural Research Service, Irrigated Agriculture Research and Extension Center, 24106 N. Bunn Road, Prosser, WA 99350, (509) 786-3454 • Project leader for a program focused on the enhancement of legume germplasm and basic and applied investigations of problems associated with legume improvement. • Developed sequence characterized DNA markers to distinguish the soilborne pathogen *Aphanomyces euteiches*, *Phytophthora medicaginis*, *Verticillium albo-atrum* and *Fusarium solani* from other closely related pathogens and for the detection of the pathogen in soils and infected plant tissue. • Produced alfalfa half-sibling families in field isolation cages. Annually increase seed of alfalfa standard check populations in field isolation cages.

July 1994–July 1998, **Professor**, CINVESTAV del IPN, Apdo Postal 629, Irapuato, Gto. Mexico 36500, (011) 52-462-39600 • Produced diallel populations of sorghum for partitioning components of genetic variance conditioning resistance to *Macrophomina phaseolina*. • Detected the presence of dsRNA elements in isolates of *M. phaseolina* and evaluated virulence of isolates towards sorghum grown under conditions of commercial field production.

June 1992–June 1994, **Staff Scientist**, Epitope, Inc., 8505 SW Creekside Park Drive, Beaverton, OR 97005 (503) 641-6115 • Isolated and screened candidate organisms for use as biological control agents against fungal pathogens. • Completed invention disclosure statements to assist the pursuit of proprietary protection for organisms for use as agents of biological control.

SELELCTED PUBLICATIONS

Larsen, R. C., Grau, C. R., Vandemark, G. J., Hughes, T. J., and B. D. Hudelson. 2004. First report of brown root rot on alfalfa caused by *Phoma sclerotoides* in Wisconsin. Plant Disease 88: 769.

Vandemark, G. J., Barker, B. M., and T. J. Hughes. 2004. Heritability of resistance to *Aphanomyces euteiches* races 1 and 2 in alfalfa. Euphytica 136:45-50.

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Larsen, R. C., C. R. Hollingsworth, G. J. Vandemark, M. Gritsenko and F. A. Gray. 2002. Use of PCR-based markers for the identification of *Phoma sclerotoides* causing brown root rot of alfalfa. Plant Disease 86:928-932.

Vandemark, G. J., B. M. Barker and M. A. Gritsenko. 2002. Quantifying *Aphanomyces euteiches* in alfalfa with a fluorescent polymerase chain reaction assay. Phytopathology 92:265-272.

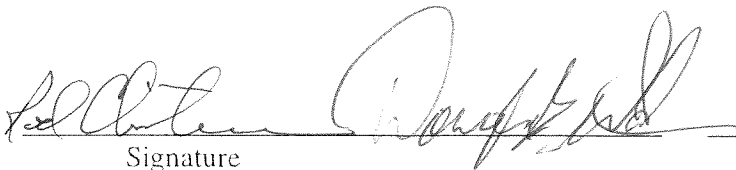
Pérez-Moreno, L., Olalde-Portugal, V., Vandemark, G., Martínez, O., Martínez-Soriano, J. P., Lara-Reyna, J., and G. Vásquez-Marrufo. 2002. Genetic relationships among isolates of *Sclerotium cepivorum* Berk. based on RAPD analysis. Revista Mexicana de Fitopatología 20:187-192.

Appendix A

CERTIFICATIONS AND ASSURANCES

I/we make the following certifications and assurances as a required element of the bid or proposal to which it is attached. I/we understand that the truthfulness of the facts affirmed here and the continuing compliance with these requirements are conditions precedent to the award or continuation of the related contract(s):

1. The prices and/or cost data have been determined independently, without consultation, communication or agreement with others for the purpose of restricting competition. However, I/we may freely join with other persons or organizations for the purpose of presenting a single proposal or bid.
2. The attached proposal or bid is a firm offer for a period of 60 days following receipt, and it may be accepted by the Department of Ecology without further negotiation (except where obviously required by lack of certainty in key terms) at any time within the 60-day period.
3. In preparing this proposal or bid, I/we have not been assisted by any current or former employee of the State of Washington whose duties relate (or did relate) to this proposal, bid or prospective contract, and who was assisting in other than his or her official, public capacity. Neither does such a person nor any member of his or her immediate family have any financial interest in the outcome of this proposal or bid. (Any exceptions to these assurances are described in full detail on a separate page and attached to this document.)
4. I/we understand that the Department of Ecology will not reimburse me/us for any costs incurred in the preparation of this proposal or bid. All proposals or bids become the property of the Department, and I/we claim no proprietary right to the ideas, writings, items, or samples.
5. I/we understand that any contracts awarded as a result of this RFP will contain terms and conditions substantially similar to those attached as Appendix B. I/we certify that I/we will comply with these or substantially similar Terms and Conditions if selected as a contractor.

_____, 2005
Signature


Title